REMARKS/ARGUMENTS

Applicants thank the Examiner for careful review of this application. The Applicants submit this Amendment in response to the Office Action, dated September 9, 2003 issued in the Application. Claims 2, 4, 6, 7, 10, 11, 15, 20 and 21 have been canceled. Claims 1, 3, 5, 8, 9, 12-19, 22 are pending. Claims 1, 5, 12, 13, 16, 17, and 18 have been amended but do not introduce new matter. Claims 23 and 24 have been added but do not contain new matter. The amendments to the claims reflect a further limitation of the confinement rings and draw from U.S. Patent 6,019,060 incorporated by reference in the application (page 4 lines 5-7 and 16-18). The specification has been amended above to correct a typographical error, which improperly referred to 160 as "ground electrode." Applicants submit that the correction of this mistake to the proper "ground extension 160" places the drawings in an acceptable form. Amendments to the specification contain no new matter. Applicants respectfully request reconsideration of the application in view of the amendments and additions and the following remarks submitted in support thereof.

Rejections under 35 U.S.C. § 112(b):

Claims 1, 13, and 18 and were rejected under 35 U.S.C. 112 as failing to provide enablement. Claims 1, 13, and 18 have been amended to further define the claimed invention.

As recited in amended claims 1 and 13, a plurality of confinement rings surround a volume within which a confined plasma is substantially disposed. The plurality of confinement rings are suspended parallel to and surrounding the first powered electrode and second electrode from within the plasma processing chamber and are capable of being raised and lowered to extend into a region above and around the first powered electrode. The ground extension has surface area within the area bounded by the rings and therefore is exposed to the volume of fluid contained within the rings. For clarity the applicants have attached a marked up copy of the drawings. The examiner will note that all embodiments of the ground extension (161, 172, 189) have been circled in the figures. The dashed line inside the confinement rings illustrates the end of the volume contained within the rings. Additionally the chamber walls have been illustrated showing ground potential in an effort to

remove any misunderstanding regarding the position of the walls with respect to the confinement rings and lower electrode. Clearly the circled portions (161, 172, 189), the ground extensions, are within the area bounded by the rings. It is accurate to say that the volume of fluid, otherwise known as a plasma, is capable of being contained in an area within the rings and above the ground extension. The ground extension also has area under the confinement rings, however the charged species within the confinement rings will seek the shortest electrical path, that is electrons will be attracted to portions of the ground extension within the rings. Claims 3, 5, 8, 9, 12, 14-17, and 22 as the examiner noted are dependent on the limitations defined in Claims 1, and 13. Applicants submit that as amended claims 1 and 13 provide sufficient clarity and enablement such that claims 3, 5, 8, 9, 12, 14-17, and 2 are likewise enabling.

Claim 18 as amended, applicants submit, is clear in that the plurality of confinement rings are positioned above and surrounding the first electrode and a portion of the ground extension. Claim 19, as the examiner noted is dependent on the limitations defined in claim 18. Applicants submit that as amended claim 18 provides enablement such that claim 19, a dependent claim, is likewise enabling.

Rejections under 35 U.S.C. § 102(b):

Claims 1, 2, 6-15, 18 and 19 and were rejected under 35 U.S.C. 102(b) as being anticipated by Li et al. (U.S. Patent Number 6,178,919, hereafter "Li"). This rejection is respectfully traversed. Claims 2, 6, 7, 10, 11, and 15 have been canceled. For the reasons put forth below, Applicants respectfully submit that Li fails to disclose each and every element of the claimed invention, as defined in independent claims 1, 13, and 18. Claims 8, 9, 12, which depend from claim 1, claim 14 which depends from claim 13, and claim 19 which depends from claim 18 are patentable for at least the same reasons as the claims from which they depend.

While it is acknowledged that the chamber walls are coupled to ground, applicants would like to add that the purpose of the confinement rings is to confine the plasma to the area within the rings and over the substrate being processed, providing a barrier (due to limitations on molecules with greater mean free path) from the chamber walls. Confinement of the plasma to a region directly over the substrate (clamped to the lower electrode) is the

goal of rings. In the claimed invention, confinement rings are suspended in a similar fashion to that shown in Figure 2 (prior art) which is representative of Lenz 5,534,751 (also of Lam Research). Li teaches a perforated plasma confinement ring 222, often called an orifice ring (if dielectric) or chamber liner (if conductor), located adjacent to or below the level of the wafer or substrate in order to reduce pumping conductance in the port 226 between the bottom electrode 210 and the interior wall 202 of the chamber (column 5 lines 20-23) . Li teaches the use of an insulating shroud 220 to further confine plasma from the chamber walls (column 5 lines 16-17). The inventions represent different embodiments of our products.

In contrast, as currently amended, claim 1 of the present invention provides a plurality of confinement rings surrounding a volume within which said confined plasma is substantially disposed. The plurality of confinement rings are suspended parallel to and surrounding the first powered electrode and second electrode from within the plasma processing chamber and are capable of being raised and lowered to extend into a region above and around the first powered electrode. A ground extension is positioned adjacent the first powered electrode in a manner that surrounds the first powered electrode. The presence of ground potential within the area defined by the confinement rings, that area in the chamber directly over the substrate and the ground extension, provides an electrical path for charged species of the plasma within the area defined by the rings. Ground potential in the area of confined plasma, within the rings and over the substrate and ground extension, is a distinct advantage over other ground sources such as the chamber walls which are outside of the immediate interaction area. As a practical consequence of the ground extension in the present invention, charged species do not see the chamber walls as ground. Occurrence of a condition known as plasma unconfinement, when the plasma extends outside of the rings, can cause undesirable results including etch non-uniformity and device damage. Accordingly, claim 1 is submitted to be patentable over Li as Li fails to teach each and every element of the claimed invention. Claims 3, 5, 8, 9, and 12, each of which depend from claim 1, are likewise patentable over Li for at least the same reasons set forth above for claim 1. Withdrawal of the rejection is respectfully requested.

With regard to the examiners comments about claim 2, confinement offered by Li does not protect the walls of the chamber from except for a shroud 220 like that pictured in Figure 3. The problem with the shroud is that it can obscure pumping conductance and optical emissions used for endpointing. While claim 2 has been canceled, the subject of claim 2 has

been incorporated into independent claim 1, which provides grounding within the confined area.

While canceled the substance of claim 6 has been incorporated in claim 1. Addressing the examiner's comments for claim 6, any ground extension not shown in the figures of Li that examiner believes surround the lower electrode are not functionally the same as a that in the claimed invention. Even if the perforated confinement ring (column 2 lines 34-45), were made of conductive material, such as anodized aluminum, called a chamber liner (conductor), and made contact with the chamber walls, it would be in a region that is not functionally over the substrate being processed. In the claimed invention the ground extension has surface area within the region bounded by vertically hung confinement rings.

Regarding claim 9, what the examiner has shown in Figure 2 is the sealing plate of the lower electrode, which is usually covered by an insulating (dielectric) ring 116 and an edge ring 118 (often a silicon hot edge ring, HER). While the presence of the HER effectively extends the target area in that its purpose is to counteract edge etching, actually it is the top electrode in all cases that is modified to be larger than the lower electrode. The larger surface area of the upper electrode improves selectivity of etch on the substrates processed by the system. The notching of the top electrode in order to obtain more surface area is a novel concept not taught by Li.

Claim 10 has been canceled as the concept has been incorporated in claim 1 as amended. The merits of the concept have been discussed above in claim 1 and canceled claim 6.

With respect to claim 11, the ground extension adjacent to the lower electrode that has surface area within the volume defined by the confinement rings (see figures 2, 3, 4, and 5) attracts electrons, draining charge from the plasma. In the configuration taught by Li, the electrons would be attracted to the walls of the chamber or the perforated confinement ring outside of the area above the bottom electrode. As a practical consequence of the ground extension in the present invention, charged species do not see the chamber walls as ground. The purpose of confinement rings in the present invention is to confine the plasma within the area over the wafer and ground extension so as to impede diffusion of charged species to the walls. It is undesirable for plasma to extend beyond the confined region. Unconfinement can sufficiently disrupt RF distribution, in some cases causing device failure on the wafer.

Regarding the examiners comments for claim 12, the claim is dependent on the limitation of the notch defined in claim 9. The notch provides for increased surface area of the upper electrode, not the lower electrode.

The arguments above for claim 1 provide a sufficient response to the examiners exception to claim 13. In amended claim 13 a defined volume within which the plasma is disposed (region where elements of the plasma cause surface interactions on a substrate), a ground extension is located within the confined volume, surrounding the first powered electrode.

With respect to the examiner's exception to claim 14, the ground extension recited in amended claim 13 provides for drainage of charge of the plasma located within the confined region and above the first powered electrode and ground extension. As discussed in claim 11 above Li does not teach drainage of charge within such an area but rather within the entire reaction chamber through the ground potential located at the walls.

Claim 15 has been canceled and renumbered as claim 23 to reflect its dependency on claim 17 which specifies a notch thereby increasing the surface area of the second electrode. The comments addressing claim 9 above provide justification for the differentiation from the teachings of Li.

In addressing the examiners exception to claim 18, applicants have amended the claim to clarify that the plurality of confinement rings are positioned above and surrounding the first electrode and a portion of the ground extension. As amended the methodology of employing a ground extension within the volume defined by the plurality of confinement rings as defined, is not taught by Li. In claim 18 of the present invention, the ground extension serves as the closest electrical path for the plasma contained within the interior space bounded by the rings (discussed at length above). Claim 19, which depends from claim 18, is likewise patentable over Li for at least the same reasons set forth above for claim 18.

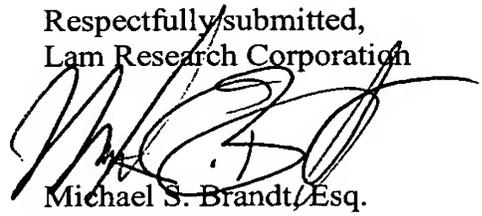
Regarding claim 22 and newly added claim 24, the substance of which is the same, the examiner provides the separation of ground potential between the lower electrode and the walls by way of the shroud taught by Li. While the applicants submit that the shroud in Li is an insulating material, the logic upon which the use of the chamber walls as a grounding medium may be undone. If the walls are effectively insulated there is no grounding within the confined area in the case of a dielectric perforated confinement ring taught by Li. However, if Li's perforated confinement ring is made of conductive material, such as in a

chamber liner, grounding would be accomplished within the area surrounded by the shroud. In the case of either dielectric or conductive perforated confinement rings in Li the insulating shroud is not physically resting on the lower powered electrode. The purpose of the insulating ring (Figure 2, 162 of the claimed invention) is to prevent an electrical short that may be accomplished if the electrode having direct RF potential is exposed in the chamber. The insulating ring and the shroud serve mutually exclusive functions within reaction chambers. Claims 24 and 22 which depend from independent claims 1 and 13, respectively are patentable over Li for at least the same reasons set forth above for claim 1 and 13.

Summary

In view of the foregoing, the Applicants respectfully submit that all the pending claims are in condition for allowance. Accordingly, withdrawal of the rejections and a notice of allowance is respectfully requested. If the Examiner has any questions concerning the present amendment, the Examiner is kindly requested to contact the undersigned at (510) 572-1667. If any additional fees are due in connection with filing this Amendment, the Commissioner is also authorized to charge Deposit Account No. 50-1842 (Order No. P0877). A duplicate copy of the transmittal is enclosed for this purpose.

Respectfully submitted,
Lam Research Corporation



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